Flask comparison on Jungfraujoch

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1. Project description

The flask sampling for the intercomparison was ongoing during the reporting period, but only between MPI Jena and the University of Bern (UBern) since CIO Groningen (RUG) stopped the comparison in 2015. For UBE, flasks were taken every week, however, not all the flasks taken in 2018 have been analysed yet. The reproducibility for CO_2 flask measurements became normal again after some difficulties in 2017.

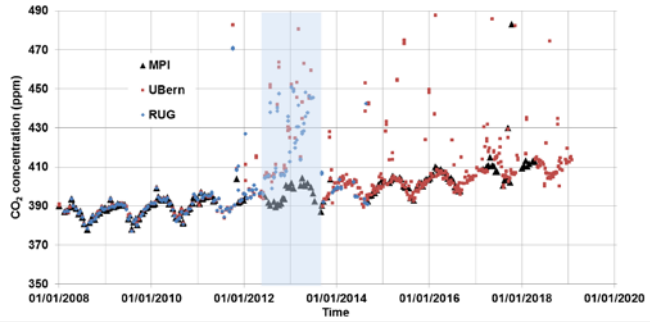

Figure 1. CO_2 concentration as measured by each laboratory. The period from June 12 to August 2013 shaded in light blue corresponds to continuously leaky conditions for the combined UBern and RUG sampling device that progressively increased.

Other measured parameters show better reproducibility again in 2018 except for oxygen. There were issues, as indicated by several high values for oxygen, with the inlet system at the laboratory of UBern (Fig. 2). We often had contaminations with inlet box gas mixtures, which we can trace by exceptionally high Ar/N_2 values since the inlet box is steadily flushed with argon. In September 2018 we changed to a new inlet system and since then the reproducibility of O_2/N_2 and Ar/N_2 has again significantly improved. The older data still requires an in-depth verification. Furthermore, the Ar/N_2 values at the time when the inlet system was changed requires checking. Note, that the Bern values are single flask measurements.

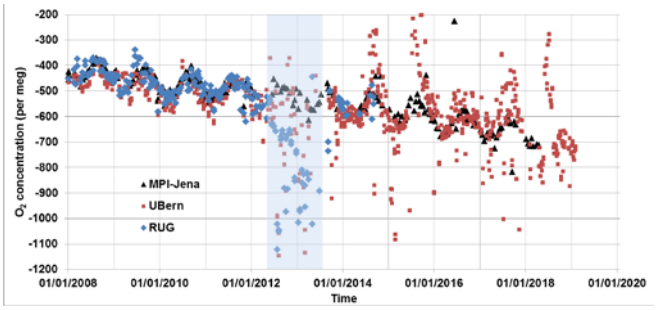

Figure 2. O_2 concentration as measured by each laboratory. The period from June 12 to August 2013 shaded in light blue corresponds to continuously leaky conditions for the combined UBE and RUG sampling device that progressively increased. UBern data unfiltered from 2012 onwards. The unexpectedly high oxygen values for the UBern flasks are not yet completely resolved but there are arguments of incomplete drying during the sampling as well as contaminations during the measurement at UBern.

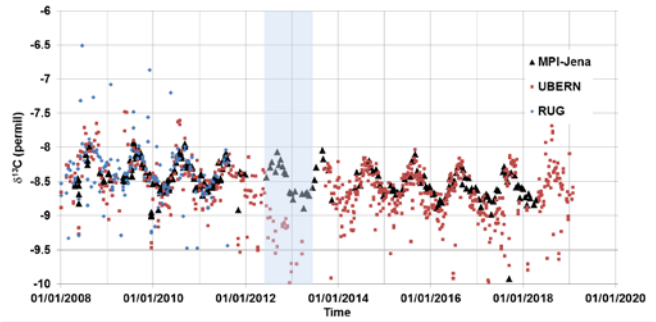

Figure 3. Carbon isotope series of Centre for Isotope Research of the Reichsuniversität Groningen (RUG), the Max Planck Institute for Biogeochemistry in Jena and the University of Bern sampled at the Jungfraujoch Research Station. The period from June 12 to August 2013 shaded in light blue corresponds to continuously leaky conditions for the combined UBern and RUG sampling device that

progressively increased. UBern data corresponds to flask means that are unfiltered from 2012 onwards.

Figure 4. Autosampler for the ICOS-Station Jungfraujoch.

Since 2018 Jungfraujoch is an official ICOS station and requires an ICOS flask sampling unit. UBern purchased such a unit but unfortunately up to now no sampling at Jungfraujoch could be performed. Several issues led to this delay: (i) the autosampler unit itself showed shortcomings when we first received it from the ICOS partner at Jena, this has been resolved by now; (ii) the flasks were delivered with long delay due to problems with the valve settings; and (iii) the flasks were then leak-tested in-house and later-on with a test-unit sent to us from Jena. This led to the conclusion that about 75% of the flasks had problems. Therefore, all flasks were brought back to the company that produced the flasks, where they are at present. As soon as we will have them back we will start with further tests at Bern and once they are in line with the ICOS requirements we will install the autosampler at Jungfraujoch. The space is already allocated.

Figure 5. ICOS flask types of 1, 2 and 3 liters.

Figure 6. ICOS flask valve test-unit.

The motor current during automated flask opening and closing can be used to identify flask problems usually caused by deviations from the specified flask dimensions that can cause leakages and flask breaks. The flask opening and closing time is 1.5s with a typical time transient as shown in figure 7. The high current at motor start cannot be evaluated. At the end of the closings and if necessary at the beginning of the openings the motor current is pulsed to increase the momentum.

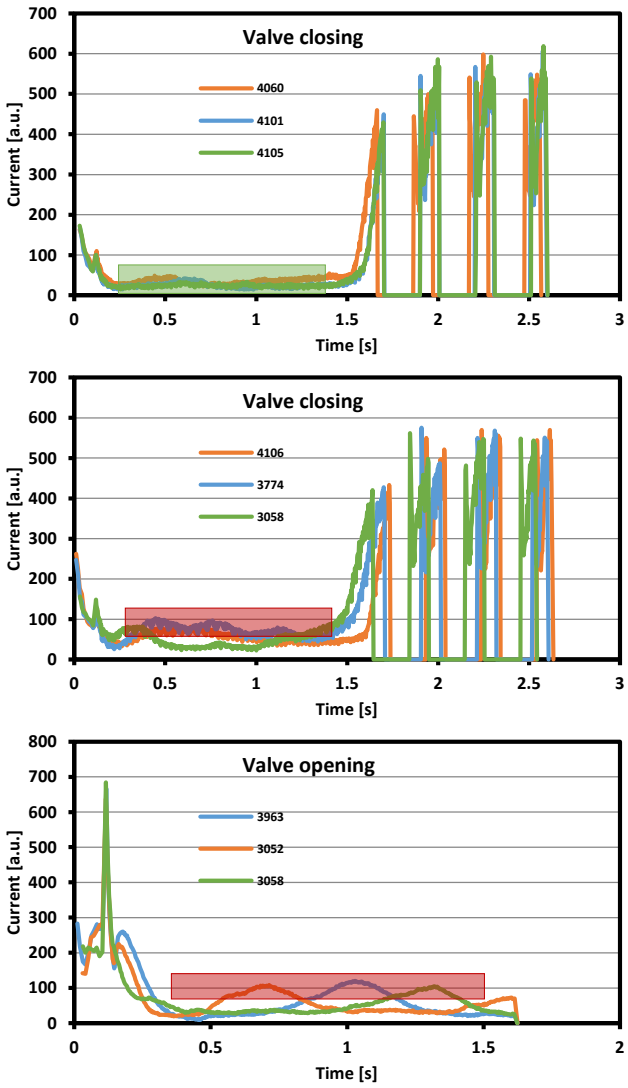

Figure 7. ICOS flask valve current measuring (a) valve closing ok, (b) valve closing bad – current above 72, (c) valve opening bad - current above 72.

Collaborating partners / networks

Prof. H. Chen and H. Meijer, University of Groningen; International Foundation Hochalpine Forschungsstationen Jungfraujoch und Gornergrat (HFSJG); Oeschger Centre for Climate Change Research, University of Bern, Physics Institute; ICOS-RI partner, ICOS-CH partners

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